CLAIMS

What is claimed is:

1. A method of preparing crystalline wafer, comprising:

providing a first composite structure comprising a support substrate and a first epitaxial layer that is in a strained state and is associated with one side of the support substrate;

relaxing the strained state of the first epitaxial layer of the composite structure to an at least partially relaxed state;

associating a receiving substrate with the first composite structure with the side of the support that includes the first epitaxial layer; and

obtaining a production wafer and a donor wafer by splitting the first composite structure at a region of weakness located therein.

2. The method of claim 1, wherein the strained state of the first epitaxial layer is relaxed by providing dislocations in a dislocation layer within the first composite structure in a configuration sufficient to relax the first epitaxial layer to a substantially relaxed state, prior to associating the receiving substrate with the structure by bonding to the relaxed first epitaxial layer.

3. The method of claim 1, wherein the region of weakness is created by implanting atomic species at a second implantation location that is spaced from the first implantation location.

4. The method of claim 3, wherein the region of weakness is disposed in the support substrate.

5. The method of claim 3, wherein the region of weakness is disposed in the first epitaxial layer.

6. The method of claim 1, further comprising providing an additional layer on the relaxed first epitaxial layer prior to associating the receiving substrate with the first composite structure, wherein the receiving substrate is bonded to the additional layer.

7. The method of claim 6, wherein the crystalline wafer is a semiconductor wafer, and the additional layer is a strained silicon layer.

8. The method of claim 1, further comprising providing an additional layer between the first epitaxial layer and the support substrate prior to associating the receiving substrate with the first composite structure, wherein the receiving substrate is bonded to the relaxed first epitaxial layer.

9. The method of claim 1, further comprising removing a layer of the production wafer disposed on an opposite side of the first epitaxial layer from the receiving substrate to provide an exposed surface.

10. The method of claim 9, further comprising providing another layer on the exposed surface of the production wafer.

11. The method of claim 10, wherein said another layer is grown on the exposed surface.

12. The method of claim 1, wherein the support substrate comprises silicon.

13. The method of claim 12, wherein the first epitaxial layer comprises silicon germanium.

14. The method of claim 1, wherein the first epitaxial layer is relaxed sufficiently to reduce the strain thereof to less than 75% of the strain than in the strained state.

15. A method of preparing crystalline wafer, comprising:

providing a first composite structure comprising a support substrate and a first epitaxial layer that is in a strained state and is associated with one side of the support substrate;

relaxing the strained state of the first epitaxial layer of the composite structure to an at least partially relaxed state by providing dislocations in a dislocation layer within the first composite structure in a configuration sufficient to relax the first epitaxial layer to a substantially relaxed state;

associating a receiving substrate with the first composite structure with the side of the support that includes the first epitaxial layer; and

obtaining a production wafer and a donor wafer by splitting the first composite structure at a region of weakness located therein.

16. The method of claim 15, wherein the dislocations are provided by implanting atomic species in the first composite structure in a dosage sufficient to facilitate or relax the first epitaxial layer to the relaxed state.

17. The method of claim 16, wherein the atomic species are implanted to produce the region of weakness.

18. The method of claim 16, further comprising creating the region of weakness spaced from the first implantation location.

19. The method of claim 16, wherein energy is added to the first composite structure to relax the first epitaxial layer.

20. The method of claim 15, wherein the dislocation layer is disposed in the support substrate.

21. A crystalline wafer, comprising:

a first composite structure comprising a support substrate having associated on one side thereof a first epitaxial layer, with the support substrate being made of a material that does not allow the first epitaxial layer to be epitaxially associated therewith in a relaxed state;

a receiving substrate associated with the support substrate adjacent the side that includes the first epitaxial layer; and

a dislocation layer located within the first composite structure in a configuration and location sufficient to impart an at least partially relaxed state to the first

epitaxial layer that is substantially more relaxed than in a stressed state in which the first epitaxial layer can be grown on the support substrate.

22. The wafer of claim 21, wherein the configuration and location of the dislocation layer is insufficient to facilitate splitting of the first composite substrate.

23. The wafer of claim 21, wherein the first epitaxial layer in the relaxation state has less than 50% of the strain than in the strained state in which the epitaxial layer can be grown on said material of the support structure.

24. The wafer of claim 21, wherein the dislocation layer contains atomic species implanted at a first implantation location in the structure, and the wafer further comprising a region of weakness to facilitate splitting of the structure comprising atomic species implanted at a second implantation location that is spaced from the first implantation location.

25. The wafer of claim 21, further comprising an additional layer connected to the first epitaxial layer.